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## THE SOCIAL BEES (MELIPONIDAE) OF BARRO COLORADO ISLAND, CANAL ZONE

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In a previous paper, consideration has been given to the solitary bees of Barro Colorado Island. The number of species of solitary bees seems small for the area in question and doubtless in course of time many species will be added to the list. In contrast, the number of social bees (all of the family Meliponidae or stingless bees) here reported upon probably represent much more nearly the actual number of species that inhabit the island. The better representation of these bees in the collections thus far made is not hard to explain. In contrast to many of the solitary bees, the Meliponidae in most instances are definitely associated with the forest or the fringes of the forest, and Barro Colorado, with the exception of a few small clearings, is heavily and continuously forested. Moreover, the visits of the stingless bees are not merely to flowers in search of pollen and of nectar but to a variety of other sites in search of building material or for other purposes. Hence, they are more in evidence than are the solitary species. Also, unlike the solitary bees, they are perennial, and a visitor to the island can as readily make the acquaintance of a given species of these stingless bees at one season of the year as at another. Although Barro Colorado is only about three miles in diameter and has an area of about 3840 acres, there have been taken within its confines thus far no less than twenty-six species and subspecies of Meliponidae. This is a rather surprisingly large number when it is considered that the known species and subspecies of Meliponidae listed by Lutz and Cockerell (1920) from all Central America, Mexico, and the West Indies, total only sixty-six, and that several of these perhaps may be considered as synonyms of other species enumerated in their list. The total is even more impressive if only the genus *Trigona* be considered. Of this genus there are twenty known species and subspecies on Barro Colorado compared with a total of forty-nine known species and subspecies recorded in Lutz and Cockerell's list for the rest of the Continent.

A key has been provided to the known stingless bees from Panama and the Canal Zone. In it have been incorporated, on the basis of a study of material loaned by various institutions, species in some cases not

previously reported from these regions; yet, even with these records included, there are only ten stingless bees known from this large area that have no representatives on Barro Colorado.

In the bibliographies that accompany each of the species mentioned no attempt has been made to cover the entire literature. For the purpose of this paper it has been deemed sufficient to give the bibliographical reference to the original description and to records of the occurrence of the particular insect in Panama or in the Canal Zone. Cases of synonymy have also been included in some cases.

Except when otherwise noted, all of the specimens here reported upon were collected on Barro Colorado Island.

KEY TO THE PANAMANIAN AND CANAL ZONE SPECIES OF MELIPONIDAE, BASED ON THE WORKER. THOSE SPECIES WITH AN ASTERISK (\*) ARE KNOWN TO OCCUR ON BARRO COLORADO ISLAND<sup>1</sup>

- 1.—The wings long, extending considerably beyond the tip of the abdomen. The stigma well developed, rather rounded below, subovate or ovate-lanceolate. Medium-sized to very small bees, ranging from 8 mm. down to 2 mm. in length (*Trigona* and *Lestrimelitta*).....2.
- The wings short, as a rule not extending beyond the tip of the abdomen. The stigma poorly developed, rather narrow and linear, tapering to a point apically, not rounded below. Large bees, rarely as short as 7 mm., more often from 9 mm. upward in length. (*Melipona*).....32.
- 2.—The outer surface of the hind tibiae gently and uniformly convex, the apical part of the joint being unmodified, without a depression or flattening; as a result, the worker suggests in its appearance a male. Head, thorax, abdomen above, and even the legs largely devoid of hair; black to dark brown and very shiny. Head large, with large malar spaces and a very short clypeus (*Lestrimelitta*).....*limão*.\*
- Hind tibiae with a more or less developed corbicula. (*Trigona*).....3.
- 3.—The marginal cell semi-open or imperfectly closed, the apical third or fourth of the marginal vein being vestigial to absent. Stigma large, approximately transparent, with usually a narrow, dark, encircling margin. The posterior border of the hind tibiae microscopically serrate. Very small bees,  $2\frac{1}{2}$  to  $3\frac{1}{2}$  mm. in length.....4.
- The marginal cell closed, the marginal vein being of virtually uniform thickness and clearly outlined to its extremity.....6.
- 4.—The coloration prevailingly yellowish, dark areas being limited to the region occupied by the ocelli, the propodeum, apical bands sometimes on tergites 1-2 of the abdomen, the apex of the hind tibiae, and outer surface of hind basitarsi. The head and mesonotum rather lightly tessellated, semi-shiny.  
*atomaria*.

<sup>1</sup>There is not included in this key Cockerell's *opaca* described from Tabernilla, Canal Zone. I have not seen the type of this species. The description of it was based on the male, no worker being available. It seems to be close to *prosopiformis*.

The coloration black or prevailingly so. The head and mesonotum dull and lustreless due to exceedingly dense, granular tessellation.....5.

- 5.—The marginal vein with a very deep, semicircular, downward bend, the low point of the bend being distant from the costal margin of the wing about three times the greatest width of the stigma. Slightly larger, 3 to 3½ mm.

*schulthessi.*

The marginal vein with the downward bend less emphatic, the low point of the bend being distant from the costal margin of the wing barely more than twice the greatest width of the stigma. Slightly smaller, 2½ to 2¾ mm.

*buyssoni.\**

- 6.—The mesonotum smooth or nearly smooth, and shiny or at least moderately shiny even when covered with hairs. ....7.

The mesonotum either distinctly and strongly punctured, or with a dense, granular tessellation, or coarsely pitted. ....27.

- 7.—The mandibles toothed from end to end along their biting edge, not merely on the inner half of it. The teeth usually distinctly separated but occasionally with thin intervening septa of chitin. The inner surface of the hind basitarsi with an oval area at the base that is either devoid of hair or covered with minute, appressed, sericeous hairs in sharp contrast with the erect brush on the apical half or two-thirds of the inner surface of the joint. ....8.

The mandibles not dentate on their outer half. The differentiated area at the base of the inner surface of the hind basitarsi, with the exception of one species (*jati\**), lacking. ....15.

- 8.—The mandibles with three, usually distinct teeth along the outer half of the apex of the mandible; a fourth tooth or merely an angle at the inner end of the apex of the mandible. ....9.

The mandibles five-toothed, the two inner teeth sometimes very small. ....10.

- 9.—The abdomen fairly broad and of reddish-yellow color. ....*fulviventris.\**

The abdomen as a rule markedly narrower than the thorax due to lateral compression, with a resulting sharp dorsal carina; black. ....*compressa.*

- 10.—Dark-colored species. ....11.

Predominantly yellow or ferruginous species, with black only in limited areas if present at all. ....14.

- 11.—The clypeus distinctly flattened, rising only barely above the sides of the face. The mandibles black from base to apex except for a narrow stripe of red just before the black apical teeth. The scape with ultramicroscopic, downlike, inconspicuous, very fine hairs. Relatively small bees, 4¼ to 5½ mm. ....*amalthaea.\**

The clypeus more arched, and apically foveate or with a slight, median, longitudinal depression. The mandibles extensively red or reddish brown, only the basal part sometimes dark, and the teeth dark. ....12.

- 12.—The hind tibiae truncate at the apex and very broad. Erect, black hairs on the clypeus fairly abundant and on the whole longer than the hairs on the scape. The mandibles blackened or sooty over approximately their basal half or third, apically red or reddish brown except for the dark teeth. Length, 6 to 7 mm. ....*nigerrima.\**

- The apex of the hind tibiae slightly emarginate, with a sub-toothlike angle where the posterior contour and the apical contour meet. Erect black hairs on the clypeus lacking or inconspicuous and stunted. The mandibles red or reddish brown except for the black basal prominences and the teeth . . . 13.
- 13.—The clypeus usually with a slight, median, longitudinal depression. The scape with short, coarse, somewhat bristle-like black hairs. The hair on the front coarse and of rather irregular growth, a little shorter but not differing otherwise in character from the hair on the vertex. Length,  $4\frac{3}{4}$  to  $5\frac{1}{2}$  mm.  
*ruficrus corvina*.\*
- The clypeus usually foveate only apically. The scape with merely fine, ultramicroscopic, downlike hairs (like those on the scape of *amalthaea*). The front with a low, even growth of ultramicroscopic hairs that are hardly traceable even when the insect is viewed from the side, and that contrast with the long, coarse hairs of the vertex. Length,  $6\frac{1}{2}$  to  $8\frac{1}{2}$  mm.  
*trinidadensis* subspecies *silvestriana*.
- 14.—Virtually unstained by dark maculations, almost exclusively honey-colored.  
*pallida*.\*
- The head black except for the honey-colored clypeus, supraclypeal area, lower corners of face, and lower half of the genae; the mesonotum black, with narrow, honey-colored lateral and hind margins; a large, black spot below on the honey-colored mesopleura . . . . . *pallida* subspecies *ferricauda*.\*
- 15.—The hind tibiae hollowed out deeply from apex to base, resembling the bowl of a spoon . . . . . 16.
- The hind tibiae of different structure . . . . . 17.
- 16.—Almost exclusively black, a few pale markings on face and thorax excepted.  
*testacea* subspecies *cupira*.\*
- Honey-colored to the virtual exclusion of black . . . . . *testacea* subspecies *musarum*.
- 17.—The hind tibiae notably widened on their apical third to apical half, rather clavate. The posterior margin of the hind tibiae fringed not only with simple hairs but with branched hairs of usually shorter length (to note the feathered character of these hairs a microscope of large magnification is needed) . . . . . 18.
- The hind tibiae more gradually widened, subtriangular, with the posterior apical angle sharp and distinct, sometimes even toothlike. Hairs on the posterior margin of the hind tibiae simple, without intermixed branched hairs . . . 23.
- 18.—The abdomen broad and short, comparable in breadth to the thorax. The face black and immaculate, with many pale hairs. The apices of tergites 2-5 and all of tergite 6 rather densely covered with such pale hairs.  
*subterranea* group.
- The abdomen elongate, very distinctly narrower than the thorax, and as a rule rather quadrangular or subcylindrical in shape . . . . . 19.
- 19.—Head, thorax, abdomen, and legs black (except that callows are sometimes ivory-colored in part, especially on some or all of the abdominal tergites). The hairs black. The wings hyaline at the base, milky white at the apex.  
*nigra* subspecies *parastigma*.\*
- Honey-colored to a large extent, with black areas and markings, in addition to frequently yellow facial markings . . . . . 20.

- 20.—The side-facial markings narrow and long, extending as a thin stripe along the inner orbit of the eye to its summit and usually rimming also the outer orbit discontinuously. . . . . *angustula doederleini*.  
 The side-facial markings broad and short, filling or approximately filling the space between the clypeus and the eye and terminated by a truncation at or below the level of the base of the antennae. . . . . 21.
- 21.—The hind basitarsi with an oval area at the base of their inner side that is hairless or with appressed, sericeous hairs sharply differentiated from the brushlike hairs on the apical half of the inner side of the joint. Upper half of mesopleura black as well as lower half. Small, about  $3\frac{1}{2}$  to 4 mm. . . . . *jati*.<sup>\*</sup>  
 Inner surface of hind basitarsi without a sharply differentiated basal region. At least upper half of mesopleura honey-colored although sometimes cloudy. Larger, 5 to 6 mm. . . . . 22.
- 22.—Tergites of abdomen rather uniformly honey-colored to reddish. . . . . *clavipes* subspecies *dorsalis*.<sup>\*</sup>  
 Tergites 2-5 very broadly banded with black. . . . . *clavipes* subspecies *perangulata*.<sup>\*</sup>
- 23.—Head exceedingly broad, at least one-third broader than long; the face hairless and for the most part honey-colored to yellowish with transparent areas. No stripes bordering the inner orbit of the eye and no stripes along the lateral margins of the mesonotum. . . . . *tataira* group.  
 Head not much broader than long. The face with appressed, pale tomentum. Stripes bordering the inner orbits of the eyes and the lateral margins of the mesonotum. . . . . 24.
- 24.—Predominantly honey-colored, including the head and thorax, and in places transparent. Length,  $2\frac{1}{2}$  to 3 mm. . . . . *mosquito* subspecies *domiciliorum*,<sup>\*</sup> new subspecies.  
 At least the head and thorax predominantly black. . . . . 25.
- 25.—The abdomen honey-colored, with usually a dark, transverse band at the extreme base of tergite 2 (overlapped by the transparent apical rim of tergite 1, with the result that the impression is created that it is the apical rim of tergite 1 that is banded). . . . . *mosquito* subspecies *jatiformis*.<sup>\*</sup>  
 The abdomen predominantly black. . . . . 26.
- 26.—Very small, 2 to  $2\frac{1}{2}$  mm. in length. . . . . *minima* (*goeldiana*).<sup>\*</sup>  
 Larger, 3 to 4 mm. in length. . . . . *mosquito* subspecies *frontalis*.<sup>\*</sup>
- 27.—The clypeus and supraclypeal region conspicuously raised, with large, coarse, relatively sparse punctures, contrasting strongly with the mostly dull and mostly much more finely and densely punctated surface of the sides of the face and the upper half of the head. The abdomen light yellowish-red in contrast to the predominantly black thorax and head, and almost devoid of erect hairs on the tergites. Hind tibiae greatly expanded. Large, about  $7\frac{1}{2}$  mm. to 8 mm. in length. . . . . *capitata* subspecies *zezmeniae*.  
 The clypeus not especially prominent, its sculpturing not conspicuously coarser than that of the rest of the head, sometimes finer. The tergites of the abdomen largely or wholly black although in some species almost concealed by heavy bands of yellowish hair. Smaller, usually under 6 mm. . . . . 28.
- 28.—Eyes strongly convergent below. The lower half of the face, as well as the upper, covered with pale tomentum. Tergites 1-2 of the abdomen polished over most of their surface and shiny. . . . . 29.

- The eyes more nearly parallel-sided, the facial quadrangle very wide and the malar space very large. Lower half of the face bare and shiny. Tergites 1-2 of the abdomen dull, due to dense, granular sculpturing. . . . . 30.
- 29.—The mandibles strongly toothed from end to end along their biting edge, quadridentate. The mesonotum dull, due to exceedingly dense but fine, granular sculpturing, without bands along its sides. The hind margin of the scutellum entire or virtually entire.
- impunctata* subspecies *isopterophila*,\* new subspecies.
- The mandibles without teeth on the outer half of their apical edge. The mesonotum rugose, pitted with large, coarse, exceedingly deep punctures. The sides of the mesonotum banded with a yellow stripe that extends on to the axillae. The scutellum with a V-shaped emargination posteriorly, the two resulting V-shaped projections, one to each side of the emargination, likewise maculated. . . . . *testaceicornis*.\*
- 30.—The mesopleura, scutellum, and legs black. The tergites of the abdomen without bands of light-colored hairs. The whole lower half of the face, as well as the upper half, black or virtually black, with at most obscure vestiges of deep reddish traceable on the clypeus or on the sides of the face adjoining the clypeus. The venation of the wings and the stigma bright orange.
- postica* subspecies *luteipennis*.\*
- The mesopleura, scutellum, and legs fulvous or largely so. Dense bands of yellowish hairs along the apical margins of the tergites of the abdomen, only these bands being usually visible on the retracted apical tergites. . . . . 31.
- 31.—The hind tibiae fringed with ferruginous hairs. . . . . *pectoralis*.\*
- The hind tibiae fringed with black hairs. . . . . *pectoralis* subspecies *panamensis*.
- 32.—The lower half of the face highly polished, strongly shiny. The abdomen black (rarely deep brown), unbanded or (rarely) at most with a faint, brown line on the apex of the basal tergites, with exclusively black hair not only on the tergites of the abdomen but on the sternites as well. Venation of the wings bright orange. Robust, 11 to 13½ mm. . . . . *flavipennis*.\*
- The clypeus and the adjacent regions of the sides of the face dull, due to dense sculpturing. At least the femora, under side of thorax, and most or all of the abdominal sternites with pale hairs. . . . . 33.
- 33.—Tergites 3-5 of the abdomen with feebly developed, narrow, broken bands that are not infrequently completely effaced on one or more of these tergites. Erect, black hairs on tergites 3-6. . . . . *fasciata* subspecies *fasciata*.\*
- At least tergites 3-5 of the abdomen with strong, continuous, bright yellow bands. The hairs on the tergites mainly or wholly pale, and for the most part semi-erect to appressed; erect, black hairs, if present, confined especially to the apico-lateral region. . . . . 34.
- 34.—The bands on the abdominal tergites exceedingly broad, those on tergites 3-5 occupying most of the exposed part of the tergite to the subordination of the black basal part. The band on tergite 1 widely interrupted, that on tergite 2 less so. A thin, crescentic line of black or brown usually imbedded in each of the halves of the yellow bands on tergites 2-4. Relatively small, 7½ to 8½ mm. in length. . . . . *favosa* subspecies *phenax*.\*
- The bands on the abdominal tergites confined to the apical region, narrow when compared with the broad basal areas of black. The bands on tergites 1-2

continuous like those on tergites 3-5. No imbedded dark lines in the yellow bands. Larger,  $8\frac{1}{2}$  to  $12\frac{1}{4}$  mm. .... 35.

35.—Tergite 6 (usually also to a lesser extent tergite 5) conspicuously clothed with feathery, white hairs, and intermixed with these on tergite 6 are long, slightly branched, black hairs, especially in the apico-lateral region. The scutellum black with usually a yellow, transverse line at apex. The angle at the posterior apical tip of the hind tibiae produced downward, distinctly spine-like. Somewhat larger,  $11\frac{3}{4}$  to  $12\frac{1}{4}$  mm. .*interrupta* subspecies *triplaridis*.\*

Tergite 6 with only simple hairs. The scutellum usually black or reddish brown basally, but almost invariably broadly yellow or yellowish red apically and on the posterior and lateral borders. The posterior apical tip of the hind tibiae usually less produced, more toothlike than spinelike. Smaller,  $8\frac{1}{2}$  to 11 mm. .... *beecheii* subspecies *beecheii*.<sup>1</sup>

### **Melipona flavipennis** Smith

*Melipona flavipennis* SMITH, 1854, 'Catalogue of Hymenopterous Insects in British Museum,' part 2, pp. 406-407.

*Melipona flavipennis* SCHWARZ, 1932, Bulletin Amer. Mus. Nat. Hist., LXIII, Art. 4, pp. 270-275 (Barro Colorado).

Workers, Nov. 12, 1923 (F. E. Lutz), and Jan. 10, 1929 (C. H. Curran). There is also a record in the card catalogue of the Laboratory on Barro Colorado of specimens collected by C. T. Greene, May 23, 1926, and determined by Rohwer.

In the British Museum are specimens of *M. flavipennis* collected by Champion at the Volcan de Chiriqui, Panama, and by Janson at Chontales, Nicaragua, which extend the range hitherto known for this insect.

### **Melipona interrupta** subspecies *triplaridis* (Cockerell)

*Melipona fulvipes triplaridis* COCKERELL, 1925, Annals and Mag. Nat. Hist., (9) XVI, p. 421 (Balboa, Canal Zone).

*Melipona fulvipes triplaridis* COCKERELL, 1928, Psyche, XXXV, pp. 171, 173 (Balboa and Barro Colorado, Canal Zone).

*Melipona interrupta* subspecies *triplaridis* SCHWARZ, 1932, Bulletin Amer. Mus. Nat. Hist., LXIII, Art. 4, pp. 286, 293, 298, 300, 304-305, 316 (Ancon, Balboa, and Barro Colorado Island, Canal Zone).

*Melipona interrupta triplaridis* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 184-185 (Barro Colorado).

Workers were collected Nov. 9-10, 1923, by F. E. Lutz; Dec. 23, 1928, and Jan. 3, 1929, by C. H. Curran; March 3, 1933, by H. F. Schwarz.

Thus far this subspecies of *Melipona interrupta* has been reported

<sup>1</sup>This species is included doubtfully, since a specimen from Barro Colorado listed in the card catalogue of the Laboratory as *fulvipes*, a synonym of *beecheii*, may have been *interrupta* subspecies *triplaridis*.

only from localities in the Canal Zone, and it is possible that its range is very restricted.

**? *Melipona beecheii* subspecies *beecheii* (Bennett)**

*Melipona Beecheii* BENNETT, 1831, in Beechey's 'Narrative of a voyage to the Pacific and Beering's Strait,' II, pp. 357-365, and plate.

In the Laboratory at Barro Colorado there is record of a specimen taken by C. T. Greene, April 14-18, 1926, and identified as *Melipona fulvipes* Guérin. The subspecies *fulvipes* is primarily confined to the West Indies and it is more likely that the insect is true *beecheii*. Even *beecheii*, however, is not known from any other locality in the Canal Zone, and it seems not improbable, therefore, that this insect was not even *beecheii*. My suspicion is that it was *M. interrupta* subspecies *tripolaridis*.

***Melipona favosa phenax* (Cockerell)**

*Melipona phenax* COCKERELL, 1919, Proc. U. S. Nat. Mus., 1920, LV, p. 195.

*Melipona orbignyi jenningsi* COCKERELL, 1919, Proc. U. S. Nat. Mus., 1920, LV, p. 199 (Las Cascadas, Canal Zone).

*Melipona orbignyi phenax* COCKERELL, 1928, Psyche, XXXV, pp. 171-173 (Bella Vista, Ancon, Balboa, Canal Zone).

*Melipona favosa* subspecies *phenax* SCHWARZ, 1932, Bulletin Amer. Mus. Nat. Hist., LXIII, Art. 4, pp. 339-341 (Ancon, Balboa, Corozal).

In the card catalogue of the Laboratory on Barro Colorado there is record of specimens collected by N. Banks on July 12, 1924, and Aug. 7, 1924; the identification was made by the Museum of Comparative Zoölogy.

Regarding specimens collected at Ancon, Nov. 21, 1923, F. E. Lutz has the following field-note:

Had nests in walls of frame houses. Entrances at edge of windows. A little mud around the hole sometimes for an inch or two from the hole. Usually a bee on guard at the hole.

Another field observation of the same writer regarding a specimen collected Nov. 7, 1923, reads:

At a yellow "morning glory" near the Ancon Hospital.

Finally, at another locality in the Panama-Canal Zone region, namely Farfan, a specimen was collected by T. Hallinan "in bat cave."

***Melipona fasciata* subspecies *fasciata* (Latreille)**

*Melipona fasciata* LATREILLE, 1809, 'Recueil d'Observ. de Zool. et d'Anat. comparée faites par Humboldt et Bonpland,' I, p. 249, Pl. xvi, fig. 13.

A single worker was collected by F. E. Lutz on Nov. 22, 1930.

The typical subspecies of *fasciata* was described from Vera Cruz, Mexico, and has been reported from Costa Rica and Honduras. This is, I believe, the first record from the Canal Zone.

***Trigona amalthea* (Olivier)**

*Apis amalthea* OLIVIER, 1789, 'Encycl. méthod.,' IV, Insectes, pp. 78-79.

*Trigona fuscipennis* FRIESE, 1900, Természetrzaji Füzetek, XXIII, p. 385 (Panama).

*Trigona amalthea* COCKERELL, 1913, Psyche, XX, p. 10 (Las Sabanas, Panama).

*Trigona amalthea* RAU, 1933, in 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 27, 37 (Frijoles, Canal Zone).

Workers of this bee have been collected as follows: Nov. 13, 1923 (F. E. Lutz), Dec. 21, 1928, and Jan. 10, 1929 (C. H. Curran), Nov. 22, 1930 (E. I. Huntington).

There are also in the collections before me specimens from the following localities in the Canal Zone: Tabernilla, July 24, 1907 (A. Busck); Empire, May 8, 1909 (A. H. Jennings); Paraiso, Jan. 17, 1911, and March 25, 1911 (A. Busck); Corozal, March 1, 1912 (A. Busck), Feb. 23, 1914 (T. Hallinan), Jan. 22, 1929 (C. H. Curran), Nov. 17, 1930 (H. F. Schwarz); Chiva Chiva Trail, Nov. 18, 1923 (F. E. Lutz), Nov. 24, 1930 (H. F. Schwarz); Ancon, Feb. 26, 1914 (T. Hallinan), April 14, 1924 (J. Zetek); Punta Patilla, Jan. 15, 1929 (C. H. Curran), Jan. 20, 1930 (H. F. Schwarz).

In the collections before me are also specimens of *amalthea* from the following localities in Panama: Alhajuela, April 11, 1911 (A. Busck); Cabima, May 18, 1911 (A. Busck); La Chorrera, April 12, 1912 (A. Busck); Chitré, April 25, 1922, on castor-oil plant (J. Zetek); Parita, April 27, 1922, on berries of *Coccoloba uvifera* Jacquin (J. Zetek); Las Sabanas, Nov. 17, 1923 (F. E. Lutz); Progreso, April 14-15, 1923 (F. M. Gaige).

***Trigona capitata zexmeniae* (Cockerell)**

*Trigona zexmeniae* COCKERELL, 1912, Annals and Mag. Nat. Hist., (8) X, pp. 313-314.

Workers of this bee were collected Feb. 18, 1929 (C. H. Curran), Feb. 27, 1933 (H. F. Schwarz), and March 4, 1933 (F. E. Lutz).

Other records from the Canal Zone are: Balboa, March 20, 1915 (T. Hallinan); Corozal, Jan. 19, 1929 (C. H. Curran).

***Trigona ruficrus corvina* Cockerell**

*Trigona ruficrus corvina* COCKERELL, 1913, *Psyche*, XX, p. 12 (Gatun, Canal Zone, and Las Sabanas, Panama).

*Trigona ruficrus corvina* WHEELER, 1913, observation on habits, *Psyche*, XX, p. 7 (Corozal and Gatun, Canal Zone).

*Trigona ruficrus corvina* COCKERELL, 1918, *Annals and Mag. Nat. Hist.*, (9) II, p. 482 (Chagres River).

*Trigona ruficrus corvina* COCKERELL, 1922, *Proc. U. S. Nat. Mus.*, LX, Art. 18, p. 8 (Punta de Peña, Panama).

*Trigona ruficrus corvina* ALLEE, 1926, *Ecology*, VII, p. 450 (Barro Colorado).

*Trigona ruficrus corvina* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 36-37, 216 (Barro Colorado and New Limon, Panama).

This subspecies has been collected as follows: Nov. 9-12, 1923 (F. E. Lutz), Nov. 12, 1923 (Sotero Murillo), March 25-26, 1924, and April 1-10, 1924 (J. C. Bradley), Jan. 11, 1929 (C. H. Curran), Nov. 14, 1930, and Dec. 1, 1930, "on dung of *Carnivora*, near rear lighthouse," and March 4-6, 1933 (H. F. Schwarz).

Other Canal Zone records are: Paraiso, Feb. 2, 1911 (A. Busck); Gatun, Nov. 11, 1911 (W. M. Wheeler); Ancon, (J. Zetek), Jan. 14-16, 1914 (T. Hallinan); Corozal, Feb. 23, 1914 (T. Hallinan); Balboa, June 28, 1914, and Nov. 18, 1914 (T. Hallinan), Nov. 19, 1930 (H. F. Schwarz); Culebra, Sept. 27, 1914, and Nov. 22, 1914 (T. Hallinan); Chagres River, Oct. 9, 1917, on *Citrus* (H. Morrison); Punta Patilla, June 15, 1929 (C. H. Curran); Summit, Nov. 26, 1930 (H. F. Schwarz).

The collections before me also contain specimens from the following localities in Panama: Punta de Peña, Aug. 6, 1906, on banana flowers (R. E. B. McKenney); Cabima, May 27, 1911 (A. Busck); La Chorrera, May 17, 1912 (A. Busck); Panama City, Feb.-March, 1915; Las Sabanas, Nov. 17, 1923 (F. E. Lutz); Boquete, March 6-22, 1923 (F. M. Gaige); Progreso, April 15, 1923 (F. M. Gaige).

***Trigona nigerrima* Cresson**

*Trigona nigerrima* CRESSON, 1878, *Proc. Acad. Nat. Sci. Philadelphia*, p. 181.

The records for Barro Colorado are as follows: Dec. 21-30, 1928 (C. H. Curran), Nov. 8, 1930 (E. I. Huntington, on Wheeler Trail), Nov. 11, 1930 (H. F. Schwarz, on Drayton Trail).

This insect has been collected also at Tabernilla, July 20, 1907 (A. Busck) and at Trinidad River, May 7, 1911, on *Citrus* (A. Busck).

*Trigona nigerrima*, of which I have seen Cresson's type, is in my estimation an insect different from what is usually designated *silvestriana* Vachal. The material on which Vachal's description of *silves-*

*triana* was based was almost certainly composite, including specimens not only from South America but also from British Honduras. The South American specimens are the same insect that Provancher had previously described as *trinidadiansis*, of which I have likewise seen the type material, and the name *silvestriana* can survive only as a subspecies applicable to the British Honduras specimens in Vachal's collection. These presumably shared the characters that differentiate all the Central American examples of the species *trinidadiansis* that I have had occasion to examine from the South American representatives of the species. The characters peculiar to the Central American *trinidadiansis silvestriana* are:

The clypeus bare instead of with small erect hairs sparsely scattered over its surface. The front with a low even growth of ultramicroscopic hairs that are hardly traceable when the insect is viewed from the side. Contrasted with the coarse hair on the vertex, these minute hairs of the front seem of a different character and quality, whereas in the typical subspecies (*trinidadiansis*) the hairs on the front grade into those on the vertex and are coarse and uneven. The scape with merely fine, downlike hairs. Average size smaller,  $6\frac{1}{2}$  to  $8\frac{1}{2}$  mm. in length contrasted with 8 to 11 mm. for the worker of typical *trinidadiansis*.

Some of the differences between *Trigona nigerrima* and *Trigona trinidadiansis* subspecies *silvestriana* are indicated in the key. Of this subspecies there are before me representatives from the following localities in Panama: Bugaba (Schaus); Boqueron River, May 1907 (A. Busck); Changuinola District, Province of Bocas del Toro; Progreso, Province of Chiriqui, April 21, 1923 (F. M. Gaige).

#### ***Trigona pallida* subspecies *pallida* (Latreille)**

*Apis pallida* LATREILLE, 1804, Annales Mus. Hist. Nat., V, p. 177, Pl. XIII, fig. 14.

*Trigona pallida* WHEELER, 1913, Psyche, XX, p. 3 (Gatun, Canal Zone).

*Trigona pallida* COCKERELL, 1913, Psyche, XX, p. 10 (Gatun, Canal Zone, and Las Sabanas, Panama).

*Trigona pallida* COCKERELL, 1920, Bulletin Amer. Mus. Nat. Hist., XLII, pp. 463-464 (Tabernilla, La Chorrera, Rio Trinidad, and Alhajuela).

*Trigona pallida* COCKERELL, 1922, Proc. U. S. Nat. Mus., LX, Art. 18, p. 8 (La Chorrera, Panama).

*Trigona pallida* SCHWARZ, 1932, Natural History, XXXII, pp. 552-553 (Barro Colorado).

*Trigona pallida* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 37-38 (Barro Colorado).

The typical subspecies of *pallida* has been collected as follows: Nov. 12-18, 1923 (F. E. Lutz), April 14, 1924, including a queen (J. C. Bradley), Dec. 19-30, 1928 (C. H. Curran), Nov.-Dec. 1930 (F. E. Lutz, E. I. Huntington, H. F. Schwarz).

Other records from the Canal Zone are: Alhajuela, May 18, 1909 (A. H. Jennings) and May 28, 1912 (A. Busck); Paraiso, Feb. 2, 1911 (A. Busck); Gatun, Nov. 11, 1911 (W. M. Wheeler); Balboa, August 21, 1914, including a male, and Nov. 20, 1914 (T. Hallinan); Empire, Aug. 30, 1914, including a male (T. Hallinan); Arrijan Trail, Dec. 16, 1914, and Jan. 1, 1915 (T. Hallinan); Corozal, Jan. 16-19, 1929 (C. H. Curran).

The following localities of Panama are represented in the collections before me: Trinidad Rio, March 16, 1912 (A. Busck); La Chorrera, April 12, 1912 (A. Busck); Porto Bello Trail, May 30, 1915 (T. Hallinan); Las Sabanas, Nov. 17, 1923 (F. E. Lutz).

***Trigona pallida* subspecies *ferricauda* (Cockerell)**

*Trigona ferricauda* COCKERELL, 1917, Psyche, XXIV, pp. 127-128 (Porto Bello).

*Trigona pallida* variety *ferricauda* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 38 (Barro Colorado).

This insect has been reported from Barro Colorado by Rau, who observed it visiting the nectaries of the red flowers of *Hibiscus rosa sinensis*. Specimens have been collected also by C. H. Curran, Jan. 10, 1929; by H. F. Schwarz, Nov. 7, 1930, and Nov. 25, 1930; and by F. E. Lutz, March 18, 1933. The specimen of Nov. 7, 1930, was taken close to the trumpet-like entrance of the nest of *Trigona fulviventris* in the "Allee tree." It was crawling about in the vicinity of the nest but did not make an actual attempt to enter the nest.

Other records from Panama are: Porto Bello, April 18, 1912 (A. Busck); Chiriqui Grande, April 15-16, 1924 (J. C. Bradley); Changuinola Dist., Bocas del Toro, May 19, 1924 (F. R. Swift).

***Trigona fulviventris* Guérin**

*Trigona fulviventris* GUÉRIN, 1845, 'Iconographie du Règne animal,' III, p. 464.

*Trigona laboriosa* SMITH, 1862, Trans. Ent. Soc. London, (3) I, p. 42. (Panama).

*Trigona fulviventris* COCKERELL, 1920, Bulletin Amer. Mus. Nat. Hist., XLII, p. 461 (Las Cruces, Porto Bello, Alafaela, Gatun, Paraiso, Alhajuela, Cabima).

"A red-bellied *Trigona*," LUTZ, 1924, Natural History, XXIV, pp. 495-496, 508 (Ancon, Fort Lorenzo).

*Trigona fulviventris* ALLEE, 1926, Ecology, VII, p. 450 (Barro Colorado).

*Trigona fulviventris* CHEESMAN, 1929, Trans. Ent. Soc. London, LXXVII, p. 150 (Cristobal).

*Trigona fulviventris* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 27, 38 (Barro Colorado and New Limon).

In the card catalogue of the Institute for Research in Tropical America the following records appear: March 23, 1926, and April 14-18, 1926 (C. T. Greene), identified by Rohwer; 1926 (W. C. Allee). In the collections before me are specimens of this species from Barro Colorado with data as follows: Nov. 11-13, 1923, including males as well as workers (F. E. Lutz), Dec. 26, 1928-Jan. 10, 1929 (C. H. Curran), Nov. 11-Dec. 1, 1930 (H. F. Schwarz), March 24, 1933 (H. F. Schwarz).

Many of these bees were collected from the nest in the "Allee tree." There has been a colony of *fulviventris* in the "Allee tree" for at least five years.

Other localities in the Canal Zone where *fulviventris* has been collected are: Tabernilla, July 23, 1907, a male (A. Busck); Paraiso, 1911 (A. Busck); Culebra, on Arrijan Trail, Nov. 27, 1914 (T. Hallinan); Gatun (A. H. Jennings); near Rio Trinidad, Gatun Lake, March 25-27, 1920 (Cornell Univ. Expedition); Ancon, Nov. 4, 1923, "nest under cement walk at foot of third post east of gate in fence along north side of main walk from Tivoli to railway station" (F. E. Lutz); Frijoles, Nov. 8-15, 1923 (F. E. Lutz); Chiva Chiva Trail, Nov. 18, 1923 (F. E. Lutz); France Field, Jan. 18, 1929, males (C. H. Curran); Fort Davis, Feb. 9, 1929 (C. H. Curran).

Localities in Panama where *fulviventris* has been collected are: Porto Bello, Feb. 15, 1911 (A. Busck); Alhajuela, April 15-17, 1911 (A. Busck), May (A. H. Jennings), Aug. 16, 1914 (T. Hallinan); Cabima, May 27, 1911 (A. Busck); Las Sabanas, Nov. 17, 1923 (F. E. Lutz); Boquete, March 1-24, 1923 (F. M. Gaige); Progreso, April 14-21, 1923 (F. M. Gaige).

#### ***Trigona nigra* subspecies *parastigma* (Cockerell)**

*Trigona stigma* WHEELER, 1913, Psyche, XX, p. 5 (Las Sabanas).

*Trigona stigma* COCKERELL, 1913, Psyche, XX, pp. 11 and 14 (Las Sabanas).

*Trigona parastigma* COCKERELL, 1918, Annals and Mag. Nat. Hist., (9) I, p. 165.

*Trigona parastigma* CHEESMAN, 1929, Trans. Ent. Soc. London, LXXVII, p. 149 (Taboga Island).

*Trigona cressoni parastigma* LUTZ, 1933, Amer. Mus. Novitates, No. 641, pp. 1-26 (Barro Colorado).

Stingless bees (*Trigona*) LUTZ, 1933, Natural History, XXXIII, pp. 571-576 (Barro Colorado).

Workers have been collected as follows: Nov. 13, 1923 (F. E. Lutz), March 1-24, 1933 (F. E. Lutz, E. I. Huntington, H. F. Schwarz).

Specimens have been taken in other localities of the Canal Zone and adjacent regions of Panama as follows: Taboga Island, Feb. 22, 1912

(A. Busck), Nov. 23, 1923 (F. E. Lutz), and "at rotten fruit" (A. H. Jennings); Caledonia Road (A. H. Jennings); Alhajuela, May 27, 1918 (A. Busck); Las Sabanas, Nov. 17, 1923 (F. E. Lutz); Chiva Chiva Trail, Nov. 18, 1923 (F. E. Lutz); Patilla Pt., Jan. 15, 1929 (C. H. Curran); Frijoles, Nov. 9, 1930 (H. F. Schwarz).

Wheeler noted (1913) a colony of this bee at Las Sabanas, near Panama City. His description of the nest entrance, "a slit shaped hole about  $\frac{1}{2}$  inch long and not provided with a waxen or cerumen spout," agrees with the conditions observed in a nest constructed in one of the wooden sides of the Laboratory on Barro Colorado. It is this species that Dr. F. E. Lutz tested as to its ability to recognize different geometric designs placed over and about its nest entrance and as to its ability to differentiate between white color that reflected ultraviolet and white color that did not (Lutz, 1933, Amer. Mus. Novitates, No. 641, pp. 1-26, and Natural History, XXXIII, pp. 571-576).

Specimens with creamy white abdomens are, as Cockerell has pointed out (1913), almost certainly callows. Even such immature specimens sometimes bear sticky building material on their hind tibiae, showing that they are already engaged in the work of the hive.

***Trigona clavipes* subspecies *perangulata* (Cockerell)**

*Trigona perangulata* COCKERELL, 1917, Psyche, XXIV, p. 125 (Alhajuela).

Workers of this species were collected by H. F. Schwarz on the following dates, mostly on the laboratory clearing on Barro Colorado: Feb. 26, 1933, March 4, 6, 9, and 24, 1933.

***Trigona clavipes* subspecies *dorsalis* (Smith)**

*Trigona dorsalis* SMITH, 1854, 'Catalogue of Hymenopterous Insects in British Museum,' II, p. 411.

*Trigona ziegleri* FRIESE, 1900, Természetrájsi Füzetek, XXIII, p. 391 (Panama).

*Trigona dorsalis* COCKERELL, 1917, Psyche, XXIV, p. 128 (Alhajuela).

*Trigona dorsalis* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 28, 29-31 (Barro Colorado).

Rau (1933) has given an interesting account of a nest of this species on Barro Colorado. In addition to the specimens he collected, workers have been taken by C. H. Curran on Jan. 11, 1929, by H. F. Schwarz on March 6, 1933, and by F. E. Lutz on March 15, 1933.

This species is represented likewise in other localities of the Canal Zone and adjacent regions of Panama, having been collected at Alhajuela by A. Busck; Ancon, Feb. 8-12, 1916 (T. Hallinan); Las Sabanas,

Nov. 18, 1923 (F. E. Lutz); Patilla Point, Jan. 15, 1929 (C. H. Curran) and Nov. 20, 1930 (H. F. Schwarz); Chiva Chiva Trail, Nov. 18, 1923 (F. E. Lutz), Nov. 24, 1930 (E. I. Huntington and H. F. Schwarz), and March 11, 1933 (H. F. Schwarz); Corozal, Jan. 21, 1929 (C. H. Curran).

***Trigona jaty* Smith**

*Trigona jaty* SMITH, 1863, Trans. Ent. Soc. London, (3) I, p. 507.

*Trigona jaty* COCKERELL, 1920, Bulletin Amer. Mus. Nat. Hist., XLII, p. 461 (Tabernilla).

Workers of this species were collected: Dec. 22-27, 1928, Jan. 10, 1929, and Feb. 13, 1929 (C. H. Curran), March 5, 1933 (F. E. Lutz), March 22, 1933 (H. F. Schwarz).

Other localities in the Canal Zone and in Panama where this species has been collected are: Tabernilla, July 23, 1907 (A. Busck); Paraiso, Feb. 13, 1912 (A. Busck); Alhajuela, May 28, 1912, (A. Busck); Boquete, Chiriqui Province, March 9, 1923 (F. M. Gaige); Progreso, Chiriqui Province, April, 1923 (F. M. Gaige) on "ocean beach"; Changuinola District, Bocas del Toro, May 26, 1924 (J. C. Bradley).

***Trigona mosquito* subspecies *jatiformis* (Cockerell)**

*Trigona jatiformis* COCKERELL, 1912, Annals and Mag. Nat. Hist., (8) X, p. 311.

Workers collected, Nov. 1930, and March 22, 1933, by H. F. Schwarz.

It is possible that *jatiformis* is the typical subspecies of *mosquito*. Smith's type of *mosquito* is unfortunately a callow while his description is based on a mature specimen. The description itself does not make mention of stripes on the sides of the mesonotum, which are conspicuous in *jatiformis*.

A fairly large series of *jatiformis* was collected by F. M. Gaige at Progreso, Chiriqui Province, Panama, April 14-20, 1933.

***Trigona mosquito* subspecies *frontalis* variety *flavocincta* (Cockerell)**

*Trigona frontalis flavocincta* COCKERELL, 1912, Psyche, XIX, p. 50.

*Trigona frontalis flavocincta* COCKERELL, 1920, Bulletin Amer. Mus. Nat. Hist., XLII, p. 462 (Paraiso).

Three workers collected as follows: March 25-26, 1914 (J. C. Bradley), Dec. 29, 1928 (C. H. Curran), Dec. 4, 1930 (F. E. Lutz).

Two of the specimens are very close to what Cockerell (1912, Annals and Mag. Nat. Hist., X, p. 314) has designated *Trigona frontalis flavocincta* variety *a*. The variability of *mosquito* is very great and *frontalis* is one of its most unstable subspecies.

**Trigona mosquito** subspecies **domiciliorum**, new subspecies

*Trigona mosquito* LUTZ, 1931, Amer. Mus. Novitates, No. 468, pp. 5-9 (Barro Colorado).

*Trigona mosquito domicilii* RAU, 1933 (without description), 'Jungle bees and wasps of Barro Colorado Island,' pp. 34-36 (Barro Colorado).

The head broader than long, smooth, rather shiny on the front, where it is semitransparent, and like the rest of the body honey-colored. A rather faded, cream-colored stripe banding the inner orbits of the eyes nearly or quite to their summit with invasions of cream-color on the clypeus, on the supraclypeal area, on the scape in front, on the labrum, and on the cheeks. The tips of the mandibles, which have two minute teeth on the inner half of their apex and are edentate on the outer half, slightly darkened; the apex of the scape (especially posteriorly) and the flagellum (especially above) blackened; a black stripe extends between the ocelli. Eyes converging below, in dead specimens grayish to blackish. The malar space small but distinct. The clypeus, front, and scape covered with a fine, pale, semiappressed tomentum; the vertex with longer, erect, pale hairs, and the inferior edge of the mandibles and to some extent also the labrum fringed with such hairs.

The thorax smooth, honey-colored, semitransparent in parts, usually so on the mesopleura, scutellum, and propodeum. The pronotum, tubercles, sides of mesonotum, axillae, and posterior margin of scutellum more or less feebly maculated with cream color. The mesonotum usually of somewhat mottled appearance. The hairs of the thorax pale, for the most part short, and of rather uniform distribution, conspicuously longer on the semicircular scutellum, and moderately long on the anterior edge of the mesonotum and on the inferior part of the mesopleura. The propodeum medianly bare.

The legs honey-colored, more or less semitransparent, with a little deepening of color sometimes on the posterior half of the outer surface of the hind basitarsi. The hairs pale, somewhat reddened on the hind metatarsal brushes, sparse on the femora, coarser on the tarsal joints of the fore and middle legs than they are on the tibiae of these legs. The hind tibiae fringed with simple hairs that are rather sparse and long. In contour the hind tibiae are subtriangular with a rather decided angulation at the posterior apical extremity. The hind basitarsi narrow, at their apex half or somewhat less than half the width of the corresponding tibiae at their apex.

The wings hyaline, with strong, metallic reflections of violet, green, and gold. The venation and stigma of not quite so clear a ferruginous as the tegulae, a little duller and diluted with brown.

The abdomen broad, short and rather flat, with the venter only mildly convex; smooth, concolorous with the rest of the body, usually semitransparent to transparent on tergites 1 and 2, which are hairless, slightly duller on the subsequent tergites, which are thinly covered with pale, semiappressed, inconspicuous hairs that are shorter than the hairs of the sternites.

Length,  $2\frac{1}{2}$  mm. to 3 mm.; width of thorax, 1 mm.; length of forewing, including tegula, 3 to  $3\frac{1}{4}$  mm.

Workers and males of *mosquito* can be differentiated structurally from the corresponding casts of *minima* virtually through their greater size only. The workers of the insect here described are intermediate in

size between typical *minima* and the smallest of the subspecies of *mosquito*. As the separation of *mosquito* and its subspecies on the one hand and *minima* on the other, if maintainable, is primarily on the basis of the architecture of the nest and the structure of the queen, and as the nest and queen of the insect here described are unknown, the allocation of *domiciliorum* as a subspecies of *mosquito* rather than of *minima* had better be considered tentative.

The present insect differs from all of the other subspecies of *mosquito* except *variicolor* Ducke in being almost wholly honey-colored with a minimum of black. The presence of black in *domiciliorum* is much more restricted than in *variicolor*, which has the upper third of the head and sometimes also the mesonotum black in whole or in part. A further distinction is that of size, *variicolor* resembling in this respect robust specimens of typical *mosquito*. The insect herein described is, on the other hand, smaller than typical *mosquito*.

This bee has thus far been recorded only from Barro Colorado. It figured in the interesting experiments made by Dr. F. E. Lutz and published under the title, 'Light as a factor in controlling the start of daily activity of a wren and stingless bees' (Amer. Mus. Novitates, March 31, 1931, No. 468). Mr. Phil Rau has contributed to the knowledge of its biology, in his 'Jungle bees and wasps of Barro Colorado,' 1933, pp. 34-36. The name *domicilii*, which I supplied to Mr. Rau, seems inadequate in view of the fact that nests of the insect have been noted in various buildings on Barro Colorado. As the name *domicilii* was published without description, I hereby replace it with the name *domiciliorum*.

The type material consists of workers collected March 25, 1924 (J. C. Bradley), Dec. 30, 1928, and Feb. 18, 1929 (C. H. Curran), Nov. 21-29, 1930 (F. E. Lutz and H. F. Schwarz). The holotype and twenty-six paratypes are in the American Museum; two paratypes are at Cornell University.

This bee is evidently preyed upon not infrequently by spiders. In company with Dr. F. E. Lutz I witnessed the leap of a salticid spider at a returning bee from the distance of about a foot. The spider spun a thread as it leaped and thus remained tethered to the spot from which the leap was made. In spite of the spontaneity of the action, the distance was very accurately gauged, for the spider barely missed its intended victim at the first try and on a second try achieved its purpose. Rau (1933, p. 36) tells of two species of salticid spiders (one of them *Marpissa magna*) that successfully took toll of the returning bees of this subspecies. Yet, although thus preyed upon by spiders, the tiny nest was not vio-

lated in a raid of *Eciton* ants that I witnessed in 1930, in spite of the fact that the marching column of ants almost skirted the nest as it scaled the wall of the building.

***Trigona minima* Gribodo**

*Trigona ? minima* GRIBODO, 1893, Bulletino della Soc. Ent. Italiana, XXV, p. 261.

*Trigona goeldiana* FRIESE, 1900, Természettajzi Füzetek, XXIII, p. 391.

Workers collected by C. H. Curran, Dec. 30, 1928.

Ducke (1925) considered *goeldiana* Friese as a synonym of *minima*. Gribodo described his *minima* as having the abdomen and legs testaceous, whereas Friese described *goeldiana* as having the legs fuscous and the abdomen fuliginous. However, callow specimens in a series frequently approach the description of Gribodo and it is difficult to know where to draw the line. From Santarem, Brazil, the type locality of *minima*, there is a specimen before me that has the darker abdomen and legs noted for *goeldiana*, and of two specimens in the American Museum referred by Friese to *goeldiana* one has the abdomen dark and the other testaceous. The specimens from Barro Colorado accord with the description of Friese's *goeldiana* in the details wherein the description of *goeldiana* differs from the description of *minima*.

***Trigona testacea* subspecies *cupira* (Smith)**

*Trigona cupira* SMITH, 1863, Trans. Ent. Soc. London. (3) I, p. 507.

*Trigona cupira* COCKERELL, 1920, Bulletin Amer. Mus. Nat. Hist., XLII, p. 464 (Cabima and Porto Bello Trail, Panama).

*Trigona cupira* COCKERELL, 1928, Psyche, XXXV, p. 171 (Canal Zone).

*Trigona testacea* subspecies *cupira* SCHWARZ, 1932, Natural History, XXXII, p. 552 (Barro Colorado).

*Trigona cupira* RAT, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 17-29 (Barro Colorado).

Workers were collected Nov. 9-10, 1923 (F. E. Lutz), Dec. 21, 1928, Jan. 4, 1929, and Jan. 11, 1929 (C. H. Curran), Nov. 10, 1930, Nov. 15, 1930, and Nov. 23, 1930 (H. F. Schwarz), Nov. 23, 1930 (E. I. Huntington), March 22, 1933 (F. E. Lutz).

The specimens collected Nov. 15, 1930, were taken on a peeled banana, the white surface of which was black with the visiting bees of this subspecies.

Attached to the Redwood House on Barro Colorado Island there was a nest of this subspecies within a structure of *Nasutitermes*. A nest of *rhumbleri*, another subspecies of *testacea*, was discovered in a structure of *Nasutitermes* at El Campamiento, Peru (Schwarz, 1929, Jour. N. Y.

Ent. Soc., XXXVII, pp. 145-149), and Ducke (1925, Zool. Jahrb. System. Geogr. u. Biol., LXIX, p. 410) remarks of *testacea* (which he has erroneously interpreted as *pallida*) that "As a tenant in the nests of tree-inhabiting termites this species (in all its subspecies) occurs frequently in Amazonia."

Specimens of *cupira* have been collected at Balboa, June 12, 1914, Aug. 20, 1914, and Nov. 8-17, 1914 (T. Hallinan); Culebra, July 4, 1914 (T. Hallinan); Culebra-Arrijan Trail, Nov. 29, 1914 (T. Hallinan); Farfan, Feb. 28, 1915 (T. Hallinan); Gamboa, Oct. 24, 1915 (T. Hallinan); Boquete, Chiriqui Province, March 8-29, 1923 (F. M. Gaige); Progreso, Chiriqui Province, April 20, 1923 (F. M. Gaige); Frijoles, Nov. 6, 1923 (F. E. Lutz), and Nov. 9, 1930 (H. F. Schwarz); Sabanas, Nov. 14, 1923 (F. E. Lutz).

Among the type material of *musarum*, one of the light-colored subspecies of *testacea*, were specimens collected on Boqueron River, Panama.

***Trigona postica* subspecies *luteipennis* (Friese)**

*Trigona bipunctata* variety *luteipennis* FRIESE, 1901, Zeitschrift für Hymenop. und Dipterologie, I, p. 382.

*Trigona pachysoma* COCKERELL, 1917, Psyche, XXIV, pp. 125-126 (Porto Bello).

Workers of this insect have been collected as follows: Feb. 26-27, 1933, March 3-6, 1933 (H. F. Schwarz), March 5, 1933 (F. E. Lutz).

Other localities in Panama where specimens were taken include Santa Rosa on the Chagres River, March 13, 1933 (H. F. Schwarz) and Pacora, March 19, 1933 (H. F. Schwarz).

The obscure red spot on each side of the face noted by Cockerell in his description of *pachysoma* is in many of the specimens wholly or nearly absent, the whole lower half of the face, like the upper half, being black or virtually black. In other specimens, not only are the obscure reddish spots in evidence on each side of the face but the clypeus itself is a deep, dull chestnut red.

***Trigona pectoralis* (Dalla Torre)**

*Trigona thoracica* CRESSON, 1878, Proc. Acad. Nat. Sci. Philadelphia, p. 181 (*nec* Smith).

*Trigona pectoralis* DALLA TORRE, 1896, 'Catalogus Hymenopterorum,' X, p. 582.

This species was taken Dec. 28, 1928 (C. H. Curran), and March 23, 1933 (F. E. Lutz and H. F. Schwarz).

A nest of this bee was observed in 1933 on the Lutz Trail between divisions 2 and 3. It was located in a tree that grew out from the side

of a bank and that partly overhung a stream bed. The nest was several feet from the base of the tree, placed midway between two converging buttresses. The entrance was a small trumpet, shaped a little like a morning-glory, with the mouth wider than the base; the circumference at the apical edge was approximately circular. The trumpet was very thin, almost paper-like or wafer-like and of a light brown color. On one side it was attached to the tree and hence it could not be removed in toto. Its partial removal took place on the afternoon of March 23. Upon revisiting the nest site the following morning at 9 o'clock, I was interested to note that the removed trumpet had been almost completely replaced by a new trumpet, of the same color and apparently of the same consistency, shaped, in so far as it had been completed, like the former trumpet and like it attached on one side to the tree.

Wheeler (1913, *Psyche*, XX, p. 6) noted a colony of this bee in Guatemala. It, too, had chosen as its nest-site a tree growing on the bank of a stream.

It is to be noted that the specimens collected on Barro Colorado tend to align themselves with *pectoralis* proper. Other examples taken in Panama and the Canal Zone are assignable to *pectoralis panamensis*, which Cockerell described (1913, *Psyche*, XX, p. 112) from Las Sabanas, Panama. Of the latter there are specimens in the American Museum from the following localities: Ancon, Feb. 27, 1914 (T. Hallinan); Balboa, June 19, 1914, Aug. 25, 1914 (T. Hallinan); Las Sabanas, Nov. 17, 1923 (F. E. Lutz); Chiva Chiva Trail, Nov. 18, 1923 (F. E. Lutz); Patilla Pt., Jan. 15, 1929 (C. H. Curran); Fort Davis, Feb. 9, 1929 (C. H. Curran); Corozal, Jan. 31, 1929 (C. H. Curran), Nov. 17, 1930 (H. F. Schwarz); Pacora, March 19, 1933 (H. F. Schwarz).

Cockerell (1928, *Psyche*, XXXV, p. 172) reported the race *panamensis* from Balboa, and Cheesman (1929, *Trans. Ent. Soc. London*, LXXVII, p. 149) reported it from Taboga Island.

#### ***Trigona* (*Nannotrigona*) *testaceicornis* Lepeletier**

*Melipona* (*Trigona*) *testaceicornis* LEPELETIER, 1836, *Hist. nat. Insect.*, Hymén., I, p. 429.

*Trigona mellarius* SMITH, 1862, *Trans. Ent. Soc. London*, (3) I, p. 42 (Panama).

*Nannotrigona testaceicornis* COCKERELL, 1928, *Psyche*, XXV, p. 171 (Balboa, Canal Zone).

*Nannotrigona testaceicornis* CHEESMAN, 1929, *Trans. Ent. Soc. London*, LXXVII, p. 150 (Taboga Island).

*Nannotrigona testaceicornis* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 16, 38 (Barro Colorado).

The Barro Colorado records of this bee in the collection before me are as follows: Nov. 12, 1923 (F. E. Lutz), Dec. 27, 1928, and Jan. 3, 1929 (C. H. Curran), March 23-24, 1933 (H. F. Schwarz), March 23, 1933 (E. I. Huntington).

There are also specimens from Tabogilla Island, Feb. 18, 1912 (A. Busck); Taboga Island, Feb. 22, 1912 (A. Busck), and Nov. 23, 1923 (F. E. Lutz); Trinidad River, June 2, 1912 (A. Busck); Farfan, Feb. 28, 1915, a male, (T. Hallinan); Balboa, Nov. 7, 1923, "at a yellow morning glory" (F. E. Lutz); Las Sabanas, Nov. 17, 1923 (F. E. Lutz).

***Trigona impunctata* subspecies *isopterophila*, new subspecies**

Worker.—Like the typical subspecies but with the maculations that characterize the latter subdued or absent. The transverse stripe that occurs in the typical subspecies just before the apex of the clypeus extinguished except for a surviving spot of yellow at its center; the narrow stripe along the inner orbit of the eye very dull. The thorax virtually immaculate: no stripes bordering the mesonotum laterally; at most a very dull red spot on the axillae and an abbreviated dull red line on the apical tip of the scutellum (even these faint vestiges of maculation sometimes absent).

Ducke speaks of the mandibles of *impunctata* subspecies *impunctata* as tridentate and so they appear when partly concealed beneath the labrum, but, when fully exposed, they prove to be quadridentate.

A colony of *impunctata* subspecies *isopterophila* was found by C. H. Curran in a deserted termite nest. Workers from this colony were collected by him Jan. 10, 1929. A specimen was also collected by F. E. Lutz, Dec. 3, 1930.

Dr. Curran has kindly supplied the following note reporting his observations on the nest:

The nest of this interesting *Trigona* was found in a deserted termite nest on a small palm tree having a circumference of about eighteen inches. The termite nest was small, about a foot high and approximately eight inches across, and located between eight and nine feet from the ground. In the face of the nest, that is to say in the surface opposite the axis of the palm trunk, was the entrance to the *Trigona* nest, a small hole, large enough for the passage of only one insect at a time.

On some occasions while the nest was under observation the bees were returning at the rate of approximately two a minute, but as a general rule only about half this number were observed. The peculiar attraction of the domicile was due to the habits of the bees, particularly the presence of a door-keeper, a habit I had not previously observed, although the phenomenon has not passed unnoticed by others. While there was no activity, the head of this guardian completely filled the entrance and as a result it was apparent only under close scrutiny and in good light, and it would easily have passed unnoticed had its presence not been known or attention attracted to it by the returning and departing bees. As a returning bee neared the nest, the head of the door-keeper would disappear and there was no loss of time in the entrance of the

worker. Rarely did the returning bee find it necessary to alight before the guardian's head would disappear from the opening and, no sooner had the worker entered, than the entrance was once more blocked. Unfortunately, the nest was too high above the ground to determine whether the same bee acted as guard continuously, but the alacrity with which it performed its duties would seem to indicate that this was so for at least a considerable period. The nest was evidently a small one and only a few bees were captured.

The type material of *Trigona impunctata* subspecies *isopterophila* is in the American Museum.

#### **Trigona near lineata** Lepeletier

*Trigona near lineata* ALLEE, 1926, Ecology, VII, p. 450 (Barro Colorado).

It is possible that this is the insect here designated *Trigona impunctata* subspecies *isopterophila* or, again, it might be what Cockerell (1917, Psyche, XXIV, pp. 126-127) described from the male as *Trigona opaca*, the type locality of which is Tabernilla, Canal Zone.

#### **Trigona buyssoni** Friese

*Trigonabuyssoni* FRIESE, 1902, Zeitschrift für Hymenop. und Dipterologie, p. 383.

*Trigona townsendi* COCKERELL, 1911, Annals and Mag. Nat. Hist., (8) VIII, p. 286.

*Trigona townsendi* COCKERELL, 1920, Bulletin Amer. Mus. Nat. Hist., XLII, p. 465 (Alhajuela).

Workers were collected by C. H. Curran on Dec. 29, 1928, and Jan. 7, 1929.

I have also seen specimens of *buyssoni* from Bugaba, Panama, collected by Champion.

*Trigona buyssoni* and *Trigona townsendi* were both described from Peru. I have compared a specimen from Escuintla, Guatemala, identified by Cockerell as *townsendi* with a type specimen of *buyssoni* from Vilcanota, Peru, and believe them to be the same insect.

Wheeler (1913, Psyche, XX, p. 5) found a single specimen of this bee in a nest of *Trigona frontalis* and expressed the opinion that it is in all probability an inquiline. This seems doubtful in view of the fact that the structurally similar *duckei* and other closely related forms among the *Trigona* are known to construct a nest, although the cells are not arranged in combs. Moreover, one of the specimens of *buyssoni* before me has pollen massed at the apex of its tibiae, an indication that the species leads an industrious life.

A close relative in Central America of *Trigona buyssoni* is *Trigona schulthessi*. Of this species there is a series from Progreso, Chiriqui Province, Panama, collected on April 20, 1923, by F. M. Gaige. From

the same locality and collected likewise on April 20, 1933, by F. M. Gaige, are specimens of another close relative, *Trigona atomaria* Cockerell.

***Lestrimellita limão* (Smith)**

*Trigona Limão* SMITH, 1863, Trans. Ent. Soc. London, (3) I, p. 506.

*Lestrimellita limao* RAU, 1933, 'Jungle bees and wasps of Barro Colorado Island,' pp. 32-34.

Specimens were collected Feb. 18, 1929, by C. H. Curran, Nov. 15, 1930, by E. I. Huntington and H. F. Schwarz, Feb. 27, 1933, by H. F. Schwarz.

All of these specimens, the capture of which extended at intervals over a period of four years, were taken from the same nest. It would be hard to say for how long a time this nest was in existence before its presence became known.

ADDENDUM

***Ceratina mexicana currani*, new name for *Ceratina mexicana zeteki***

In a recently issued paper on 'The solitary bees of Barro Colorado Island, Canal Zone' (1934, Amer. Mus. Novitates, No. 722) I named (p. 10) a new variety (*zeteki*) of *Ceratina mexicana*. Through a strange coincidence Professor T. D. A. Cockerell, wishing likewise to honor Mr. James Zetek, selected that name for yet another species of *Ceratina*, and his paper, published in the May, 1934, issue of the Entomologist, LXVII, p. 107, made its appearance about a week in advance of mine. Thus his *Ceratina zeteki* would seem clearly to have priority. Therefore, I designate the *Ceratina* from Barro Colorado Island *Ceratina mexicana currani* in honor of Dr. C. H. Curran, who collected the type specimen. I am indebted to Professor Cockerell for bringing this inadvertent duplication to my attention.

